

# Human Powered Vehicle

## Problem Definition and Project Plan

Yousef Alanzi, Evan Bunce, Cody Chenoweth,  
Haley Flenner, Brent Ives, Connor Newcomer

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# Overview

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# Introduction

- American Society of Mechanical Engineers (ASME) enables collaboration, knowledge sharing, career enrichment, and skills development across all engineering disciplines, toward a goal of helping the global engineering community develop solutions to benefit lives.
- NAU ASME's primary focus points
  - projects run by the students (Human Powered Vehicle (HPV) , Student Design Competition, RC Baja)
  - speakers and tours that help the students network with industry professionals
  - Career development seminars (Student Professional Development Conference, Career Workshops)



Source: Nau.edu



Source: Nau.edu

# Introduction Continued

- Perry Wood

- Professor at NAU for 12 years
- ASME Adviser for 8 years
- Has been a part of HPV for 8 years
- NAU Machine Shop manager for 12 years
- Studying for his PhD in mechanical engineering emphasizing in fatigue characterization of magnetic shape memory alloys



Source: Nau.edu

# Need Statement

- Human powered vehicles are the best way in underdeveloped countries to commute, but they lack efficiency, reliability, and safety for the people using them.

# Project Goal

- The goal of this project is to eliminate vehicles by designing and building safe, efficient, and reliable vehicles that can be powered by humans.

# Objectives

- Attain speeds greater than 30 mph
- Lightweight material to reduce overall weight
- Frame can support additional weight from various items
- High maneuverability
- Driver safety

# Constraints

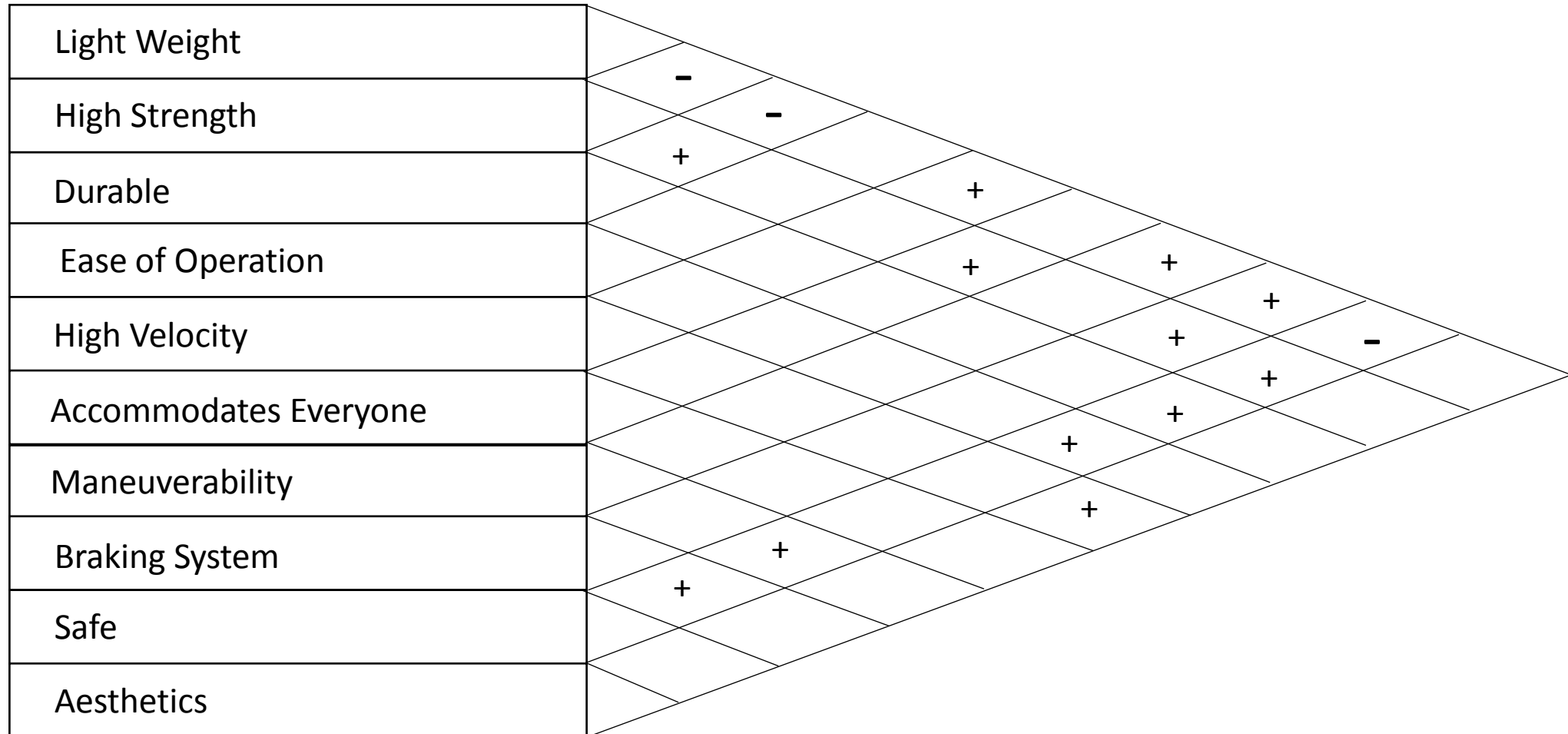
- Can not be the vehicle from previous years
- Must be able to fit every individual team member inside
- Need some form of turning signals
- Brakes and seatbelt
- Driver must have a field of vision of 180 degrees



# Quality Functional Deployment

Customer Needs	Engineering Requirements	Lightweight	High Strength	Durable	Ease of Operation	High Velocity	Accommodating to All Persons	Manuverability	Braking System	Safe	Aesthetics
Solely Human Powered					x		x				
Travel at Least 10km				x				x			
Has a Rollover Protection System		x	x	x						x	
Comes to a Stop Within 6m While travelling 25km/h						x			x		
Turns Within an 8m Radius								x			
Travels Straight for at least 30m								x			
Utilizes a Safety Harness										x	
Contains no Hazardous or Sharp Edges										x	
Sustains Forces of 2670N and 1330N to the Top and Side of Vehicle, Respectively			x	x						x	
Accommodates Any and All Team Members							x				
Aesthetically Pleasing											x

# House of Quality



# Project Plan

Task	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8	Week 9	Week 10	Week 11	Week 12	Week 13
Meet with client													
Problem definition													
SOTA research													
Establish objectives/constraints/requirements													
Concept generation													
Rudimental concept evaluation													
Refinement of select concepts													
Concept evaluation													
Concept selection													
Concept simulation													
Initial analysis/simulated testing													
Objective prioritization													
Design/model refinement													
Design review													
Model synthesis													
Design review													
Presentation/report finalization													

# State of the Art Research

- Material in which they are constructed
  - Alloys
  - Composites
- Variations in design
  - Rider position
  - Recumbent designs
- Aerodynamics



Source: Atomic Zombie



Source: Atomic Zombie

# Conclusions

- Human powered vehicles are usually used in underdeveloped countries, but they lack in efficiency, reliability, and safety
- The goal of this project is to eliminate vehicles by designing and building safe, efficient, and reliable vehicles that can be powered by humans
- Design objectives include high speed, light weight, high strength, high maneuverability, and a high degree of driver safety
- Constraints include a new design with turn signals, brakes, a harness, a 180° field of view, and pure human power
- Current competition vehicles are made of metal alloys or composites, or a mixture of both, with a recumbent riding position and minimal aerodynamic effects

# References

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- "AtomicZombie - The Warrior Recumbent Tadpole Racing Trike." AtomicZombie - The Warrior Recumbent Tadpole Racing Trike. N.p., n.d. Web. 23 Sept. 2015.
- Dieter, George. Engineering Design: A Materials and Processing Approach. New York: McGraw-Hill, 1983.
- "The Recumbent Bicycle and Human Powered Vehicle Information Center." The Recumbent Bicycle and Human Powered Vehicle Information Center. N.p., n.d. Web. 23 Sept. 2015.